

Claim 1 includes the feature of "an adherent layer of palladium on [a] palladium film." Claim 1 also indicates that the adherent layer of palladium layer selectively covers areas of the leadframe suitable for bonding wire attachment and solder attachment. Kim does not teach or suggest such features. In Figure 5, Kim shows a Pd-X *alloy* layer over a strike-plated Pd layer, not a layer of palladium on a palladium film. In addition, Applicant cannot find a teaching or suggestion in Kim of selective deposition of *any* layer. Therefore, Applicants submit that Claim 1 is patentable under 35 U.S.C. 102(b) over Kim. Claims 2, 3, 5, and 9 depend from Claim 1 and are therefore patentable over Kim for at least the reasons presented above for that claim.

Claims 4, 6, 10, and 11 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kim. Applicants respectfully traverse the rejection.

Claims 4, 6, 10, and 11 depend from Claim 1. As indicated above, Kim does not teach or suggest all of the features of Claim 1. Therefore, Claims 4, 6, 10, and 11 are patentable under 35 U.S.C. 103(a) over Kim. In addition, Claim 4 includes the feature of "a stack consisting of a nickel layer in the thickness range from about 30 to 50 nm, plated onto said base metal, followed by a palladium/nickel layer in the thickness range from about 30 to 50 nm, followed by a nickel layer in the thickness range from about 1.0 to 3.0 μm ." In contrast, Kim (col. 1, line 67 to col. 2 line 3) teaches a Ni strike plated layer about 5 $\mu\text{-inches}$ thick, a Pd/Ni alloy layer about 3 $\mu\text{-inches}$, and a Ni layer of undisclosed thickness. There is no suggestion in Kim of using layers having dimensions recited in Claim 4. Claim 6 includes the feature "wherein said palladium layer has a thickness from about 70 nm to 90 nm." As indicated above, Kim's layer 54 in Figure 5 is not a palladium layer. With regard to Claim 11, Applicant respectfully submits that the Examiner seems to have mistakenly read a physical characteristic (i.e. the solder layer's reflow temperature) as a process limitation. For at least these reasons, Applicants submit that Claims 4, 6, 10, and 11 are patentable over Kim.

Claims 7-8 and 12-16 stand rejected under 35 U.S.C. 103(a) as being unpatentable over Kim in view of Tsuji, et al. (U.S. Pat. No. 5,521,432). Applicants respectfully traverse the rejection.

Claims 7 and 8 depend from Claim 1. As indicated above, Kim does not teach or suggest all of the features of Claim 1. Tsuji's teaching of a lead frame made of nickel partially plated with palladium does not cure the above-cited defects of Kim. One skilled in the art would receive no motivation from either Kim or Tsuji for a combination of the teachings and suggestions therein to arrive at the features described in Claims 1, 7, or 8. Therefore, Applicants respectfully submit that Claim 7 and 8 are patentable over the combination of Kim and Tsuji. Similarly to Claim 11, the Examiner appears to have read the distinctive physical feature in Claim 8 as a process limitation. Such a reading is not correct. Claim 8 describes a characteristic of the palladium layer, it does not describe the process of visual distinction.

Claim 12 includes the features of "said leadframe further having an adherent layer of palladium on said palladium film, selectively covering said second ends of said lead segments in a thickness suitable for solder attachment, and further selectively covering the bonding wire attachment areas on said first ends of said lead segments in a thickness suitable for bonding wire attachment" As indicated above with respect to Claim 1, Kim does not teach or suggest an adherent layer of palladium on a palladium film. Tsuji does not cure that deficiency of Kim. Note also that neither Kim nor Tsuji teach or suggest selective deposition of palladium in bonding wire attachment areas of lead segments. In Tsuji's Figures 8 and 9, bonding areas 23 are shown differently than are areas 21. In column 6, at lines 48-54, Tsuji specifies that areas 23 are either silver or gold, not palladium. Claims 13-16 depend from Claim 12 and are therefore patentable for at least the reasons presented above for that claim.

Applicant respectfully requests withdrawal of the rejections and allowance of Claims 1-16 and 21-24. If the Examiner has any questions or other

correspondence regarding this application, Applicant requests that the Examiner contact Applicants' attorney at the below listed telephone number and address.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "M. Skrehot", written in a cursive style.

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Version with Markings to Show Changes Made

Title

[PALLADIUM-SPOT] LEADFRAMES FOR HIGH ADHESION
SEMICONDUCTOR DEVICES AND METHOD OF FABRICATION

Specification

Page 18, 2nd full paragraph.

As shown in FIG. 4 schematically, leadframe 401 comprises base 406 made of copper or copper alloy. On the surface of this copper is a sequence of layers, described in detail in FIG. 2. Closest to the copper is a first layer 407 of nickel. This layer is actually a stack of layers, followed by spot-plated layers 408 and 409 of palladium. Palladium layer 409 [609] is incorporated into the meniscus of the bulk solder 410 [610] in the process of surface-mounting device 400 onto a substrate or board 420.

Claims

7. (amended) The leadframe according to Claim 1 wherein said film of palladium is sufficiently thin that the surface of said leadframe not covered by said layer of palladium comprises nickel and nickel oxide as well as palladium [palladium layer covers selective areas having boundaries of loose tolerance].

21. (new) A semiconductor device, comprising:

a leadframe, comprising:

a first layer of noble metal covering said leadframe;

a second layer of said noble metal covering portions said first layer of said noble metal, wherein said first layer of said noble metal is thinner than said second layer of said noble metal.

22. (new) The semiconductor device of Claim 21, wherein said noble metal is palladium.

23. (new) A semiconductor device, comprising:

a leadframe, comprising:

a film of palladium on said leadframe;

a layer of palladium covering portions of said film of palladium.

24. (new) The semiconductor device of Claim 23, further comprising a layer of nickel on said leadframe onto which said film of palladium is deposited, wherein said film of palladium is sufficiently thin that the surface of said leadframe not covered by said layer of palladium comprises nickel and nickel oxide as well as palladium.